A

REPORT

on the

COCONINO NATIONAL FOREST

By

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Flagstaff, Arizona,

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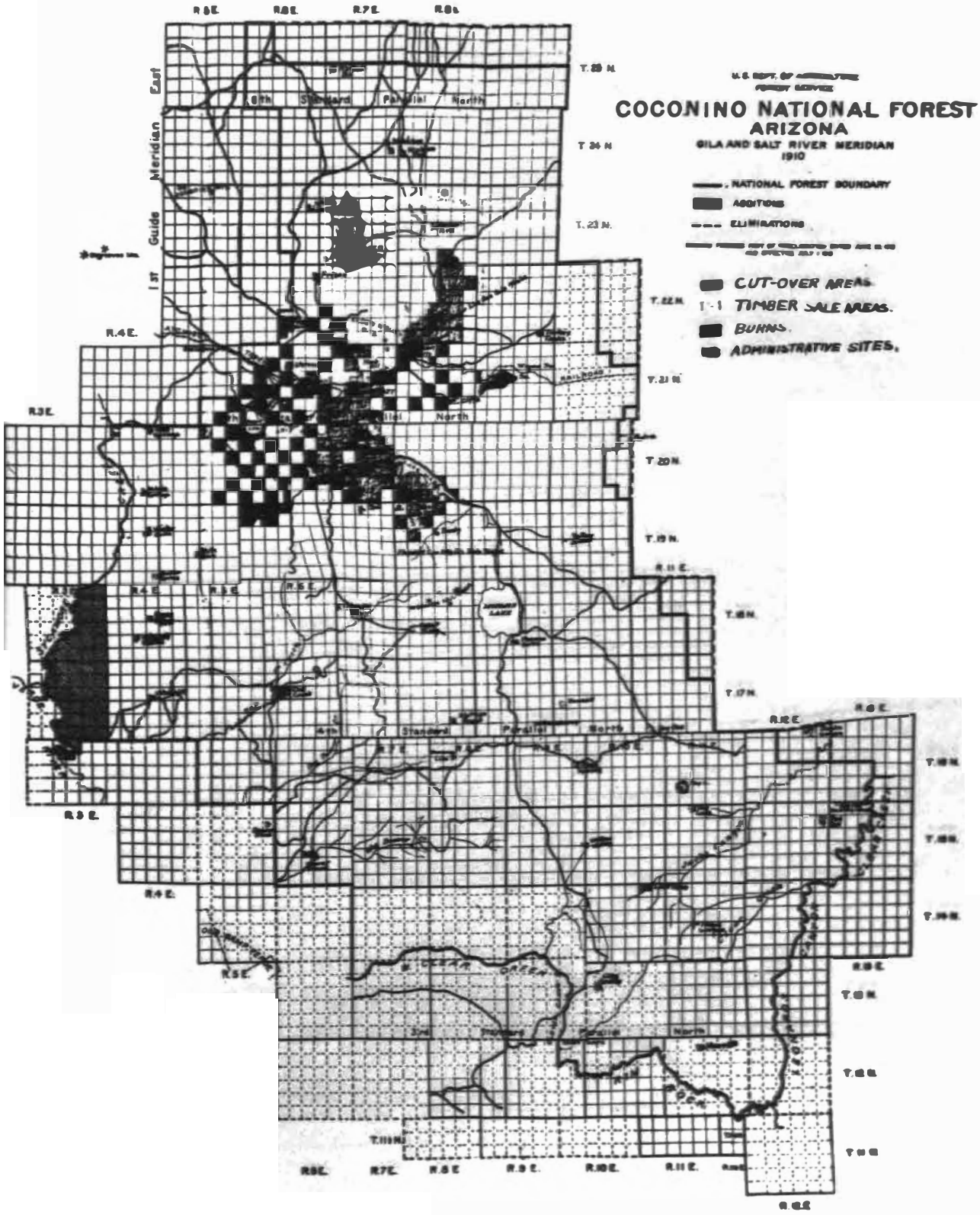
COCONINO NATIONAL FOREST
ARIZONA
GILA AND SALT RIVER MERIDIAN
1910
NATIONAL FOREST BOUNDARY
ADDITIONS
ELIMINATIONS
CUT-OVER AREAS
TIMBER SALE AREAS.
BURNS.
ADMINISTRATIVE SITES.
Guide East
1st
Standard
Parallel
North
T. 25 N.
T. 24 N.
T. 23 N.
T. 22 N.
T. 21 N.
T. 20 N.
T. 19 N.
T. 18 N.
T. 17 N.
R. 4 E.
R. 3 E.
R. 5 E.
R. 6 E.
R. 7 E.
R. 8 E.
R. 9 E.
R. 10 E.
R. 11 E.
R. 12 E.
Oak Creek Canyon
Oak Creek
Flagstaff
Mormon Lake

COCONINO NATIONAL FOREST.

Area
1,679,282 Acres

Headquarters
Flagstaff, Arizona.

The Coconino National Forest is located on a high timbered plateau which breaks gradually on the north and east to the valley of the Little Colorado River and which breaks abruptly on the south to the valley of the Verde River. The area which contains saw timber amounts to approximately 868,055 acres of which 7,000 acres are unmerchantable burned-over areas, and 50,000 acres protection forest (unmerchantable either on account of topography or on account of open stand of timber). It is estimated the total amount of standing timber amounts to 3,193,507,000 feet B.M., 95% of which is Western Yellow Pine and the remainder divided up irregularly between Engelmann spruce, red fir, white fir, limber pine and Arizona cork bark fir. The woodland of the Forest covers a total area of 571,227 acres, of which 3,200 acres are unproductive on account of recent serious fires. This area is estimated to contain 3,500,000 cords of fire wood. This stand is made up of about 75% of species of the juniperous family and about 25% of the species of the pinon family. As no careful estimate has ever been made of this area the total amount in the juniperous species is not definitely determined. The remaining area amounting to 240,000 acres is either agricultural land or open park land of which about 5,000 acres are

at present under cultivation and approximately 10,000 acres additional are suitable for cultivation.

Using the available growth data, the estimated annual growth of the Forest of saw timber is .728% or is equivalent to 25,548,056 feet B.M. per annum. In view of the fact that the greater part of the timber on this Forest is now mature or in decaying state, it has been deemed advisable for a period of years to cut more than the annual growth and the annual cut authorized at the present time is 32,000,000 feet B.M.

In the woodland area the estimated, sustained, annual growth is about 15,000 cords, but on account of the lack of demand for this class of material and very poor market, the amount authorized to be cut has been reduced to 4,000 cords which is fully sufficient to meet present needs.

The saw timber which is cut on the Forest annually is marketed about one-third in Arizona and New Mexico, about one-third in California and about one-third in points east of New Mexico, mainly in Kansas, Nebraska and Colorado.

There are but two permanent streams on the Forest, one of which, Oak Creek, has approximately five thousand undeveloped horse power and the other, Wet Beaver, which has possibly an undeveloped horse power of five hundred. No power has been developed on either of these streams and the only use made of the water at present is for irrigating small ranches along the two streams and for watering stock which range on the Forest. The Forest supports about 33,900 head of cattle

and 89,500 head of sheep on which fees are paid and 550 head of cattle and 7,556 head of sheep graze free in lieu of exclusive use of private land which is waived. The range on this Forest is considered the best in Arizona. There are no National Parks or Monuments on this Forest.

The present force of the Coconino Forest consists of:

1 Acting Forest Supervisor
2 Forest Clerks
4 Forest Assistant
5 Forest Rangers
7 Assistant Forest Rangers
2 Guards (1 Hunter)

and the Coconino Experiment Station, which is under the jurisdiction of this office has a force of:

1 Forest Examiner
1 Forest Clerk
2 Forest Assistants
1 Guard.

Topography and Drainage

The Coconino Forest covers a flat timbered plateau forming the division between the Verde and Little Colorado Rivers. Near the north end of this plateau occurs the San Francisco Peaks and Eldon Mountain. At the extreme southern end is found the high rim of Tonto Basin and Baker's Butte. Near the center occurs a number of prominent peaks known as Woody Mountain, Mormon Mountain and Hutch Mountain. The general level of the plateau varies from 6,500 feet to 7,500 feet, while the San Francisco Peaks reach an altitude of 12,611 feet. None of the other peaks or mountains go above 10,000 feet. The southern boundary of the Forest really consists of a big rim where

there is a precipitous drop of nearly 2,000 feet in elevation forming the boundary between the Coconino Forest and the Tonto Forest. In the southwest corner of the Forest this rim is not so prominent, but is still 1,000 feet high and more broken, breaking abruptly into the valley of the Verde River. On the east the high plateau breaks gradually down into the valley of the Little Colorado River. The elevation of the southern portion of the Forest varies from 4,000 feet to 5,000 feet according to the locality. The entire plateau apparently originated as the result of an uplift of a vast tract of territory. During or since this uplift a number of volcanoes have occurred covering the greater part of the plateau with a bed of lava two or three hundred feet deep and in some places leaving an immense amount of volcanic ashes and cinders. The larger part of the old volcanic cones are founs in the norhh end of the Forest, north and east of the San Francisco Peaks. The general surface of the plateau is somewhat rolling with a difference in elevation of about 100 to 250 feet. From a forestry viewpoint, on account of the easy topography, the Forest can be considered as a single large drainage area as the divide is very easily crossed by railroad or wagon roads.

There are on the Forest 91,375 acres of cut-over land. Of this area, 91,055 acres are in the yellow pine type and 320 acres in the woodland type. 80,320 acres of the cut-over land belong to the Government and 11,055 acres are in private habds. The bulk of this cut-over land is restocking naturally and it is probably that in the course of time all of

it will become restocked. About 20,000 acres of this land is restocking so slowly on account of the severe cutting which was made on the area, that it will probably not become restocked during this generation. Natural restocking in this region is not very general but is, on account of weather conditions, usually spread over a considerable period of time, and artificial restocking has, up to the present time, not met with real success. The higher portions of the Forest are covered with saw timber, of which the total stand, as stated above, is 3,193,507,000 feet B.M. The areas in the lower elevation contain a stand estimated to be 3,500,000 cords and are in the woodland type. Parks are found scattered throughout both types of the Forest and the areas in the saw timber types usually contains more or less land suitable for agricultural purposes, part of which is at present under cultivation. The total area of such parks is estimated to be 240,000 acres and but a small percentage of it, probably 15,000 acres are suitable for agricultural land. In general the burns which have occurred on this Forest have done serious damage only to the reproduction. The standing thrifty timber usually escapes without serious damage.

Several old fires of small area have occurred in the woodland type, but on account of the long period of time since they occurred they are gradually seeding up. There are two large fire areas, however, on the Forest which have not reseeded as yet. There is an old fire area of about 7,000 acres on the San Francisco Peaks where a crown fire occurred in the

Engelmann spruce type about thirty years ago, making a clean sweep of the timber. On part of this area the aspen has gained a foothold, but the timber species have not as yet made any headway towards restocking the area. This entire area is within the protective forest and the new planting operations will probably for some time be confined to this area.

During last May a fire occurred in the woodland type in the cedars about twenty miles east of Flagstaff. Approximately 5,209 acres were burned over and this was a clean burn. It will probably be a considerable number of years before this area is restocked by the woodland type.

The attached map shows the divide between the Verde and the Little Colorado Rivers and shows the drainage from the Forest by means of the present water courses, most of which, as previously stated, are dry the larger part of the year.

Status

The following table shows the present status of land on the Coconino National Forest:

	Acres	Percent
Land now patented	66,583.25	
Land listed under Act of June 11, 1906	8,162.78	
Land retained by the RR Co.	5,057.72	
Land to become RR when surveyed	15,360.00	
Total	95,163.75	7.5%
*(Doubtful, see note)		
On odd sections	6,380.00	
On even sections	640.00	
Total	7,020.00	.4%

* This land has been deeded to the United States by private parties not under special agreement and script was furnished

	Acres	Percent
School and University	82,624.60	4.9
Government timber	1,422,463.13	84.7
Reconveyance pending	72,010.52	4.3
Grand Total	1,679,282.00	100.00

This Forest is entirely dependent for its water supply on the annual rainfall. This amounts to about twenty-three inches per annum on the higher parts of the Forest and to approximately eighteen inches on the lower parts of the Forest. The water obtained from rainfall is stored in a few natural lakes scattered throughout the entire Forest and in a large number of artificial dams or tanks built by the stockmen for this purpose. There are scattered throughout the Forest at very irregular intervals, a large number of small springs or creeks which flow during the wet period of the summer, but the greater part of them dry up during the dry season of each Spring. There are a small number of permanent springs of moderate size on the Forest, the most important of which is Jack Smith Spring from which the Town of Flagstaff obtains its water supply.

There are two permanent streams on the Forest, both of small size and both located in the Verde River drainage. These are Oak Creek and Wet Beaver Creek. There are several other streams that flow from four to ten months each year located on the Forest or on its boundaries, among these are, Sycamore Canyon, forming a part of the boundary between

* Cont. from page 6:
them under the Act of June 4, 1897. The script was not used within the period required when the aforementioned Act was repealed and the present ownership of the land has not yet been determined.

the Coconino and Tusayan Forests; Dry Creek in the Verde drainage just southeast of Sycamore Canyon; Dry Beaver Creek which unites with Wet Beaver Creek to form Beaver Creek, and West Clear Creek which forms part of the boundary between the Coconino and the Tonto Forests. On the east side of the Forest we have East Clear Creek which forms part of the boundary between the Coconnino and Sitgreaves Forests; Jack's Canyon; Jay Cox Canyon; Grapevine Canyon; Walnut Canyon and the San Francisco Wash. The Walnut Canyon Wash at present does not usually run beyond the Lake Mary Dam in Clark's Valley as this dam stops all of the surface water from the higher part of the Forest from going down the canyon. The River de Flag which runs through the Town of Flagstaff, draining the San Francisco Peaks, always flows for several months in the year and would, if the water were not stopped, ultimately join with Walnut Canyon to form the San Francisco Wash, but the large railroad embankment near Cliffs, Arizona together with the bottomless pits stops the flood waters from following the channel and through the bottomless pits removes the surface water thus stopped. In normal years there is a plentiful supply of water for the inhabitants of the Forest, for the industries, mainly lumbering, agriculture and grazing.

Water Power.

As there are but two permanent streams on the Forest and water power is dependent always upon a continuous supply of water, the only water power on the Forest would be what

occurs on these two streams. It is roughly estimated, as stated above, that the undeveloped water power of Oak Creek amounts to about 5,000 horse power, and that the undeveloped water power in Wet Beaver Creek would amount to about 500 horse power, giving a total undeveloped horse power of 5,500. There is no developed water power whatever on this Forest.

Timber

The saw timber type of the Coconino National Forest has been thoroughly examined and estimated during the past two years and Mr. Allison, who was in charge of this work, is now drawing up a working plan for this type on this Forest. As Mr. Allison's estimates were very conservative, it has been found necessary, in order to get somewhat nearer accurate figures, to consider them but 75% of the volume that the area will cut in each case. In this way the total stand of the Forest Amounts to 3,193,507,000 feet B.M. No actual detailed estimate has ver been made of the woodland type of this Forest, but it is conservatively estimated at about 3,500,000 cords. There are four types of timber on this Forest; the yellow pine type, the transition type, the Engelmann spruce type and the woodland type. In addition to these are the open parks and agricultural lands. The following table gives the representative areas of the different types:

Type	Acres	Percent
Yellow Pine	843,055	50.2
Transition	20,000	1.2
Engelmann spruce	5,000	0.3
Woodland	571,227	34.0
Park & Agricultural	240,000	14.3
Total	1,679,282	100.0

In order that you may more fully understand each type I will briefly describe them:

Western Yellow Pine Type:

As the type name indicates, Western Yellow Pine, (Pinus ponderosa) is the characteristic species generally forming in this type a nearly pure and often very open stand of mature timber with few young trees in the mixture. Only in very scattered areas do the crowns form anything like a continuous cover. The trees are usually found in groups especially in the drier and less favorable locations. The yellow pine usually makes up about 95% of the stand with small groups of gambel oak, and alligator juniper in the lower part of this type and at the upper limits of the type, scattered individual trees of white fir, red fir and limber pine and in some of the more moist situations, clumps of aspen. Scattered throughout this type are more or less extensive, but rather small parks, In that part of the Coconino Forest, lying along the Mogollon Rim and east of Baker's Butte there is a small sub-type in which the yellow pine still represents over half of the total volume, but is mixed in with a considerable quantity of limber pine, white fir and Douglas fir. As the yellow pine is still in this part of the type, the best tree and the only one of present commercial value, it seems advisable to consider it as part of the usual type. This type is found at an elevation between 6,000 feet and 8,500 feet.

Western yellow pine is a rather shallow rooted tree

and varies in height from 50 feet to 125 feet, dependent on the favorable character of the situation, and its breast high diameter is from 10 to 50 inches, with a clear length of mature timber of from 10 feet to 40 feet, dependent largely upon whether the trees are found scattered as individuals or in groups. Naturally the longest lengths, clear, are found in the larger groups. Expept on the young trees the limbs are very large and the taper of the bole near the upper end of the crown is very rapid. As a result the top logs which come from within the crown are usually expensive to limb and saw and make only low grade lumber. The mature timber usually varies from 200 to 350 years of age.

The gambel oak (Quercus gambelii) and alligator juniper (Juniperus pachyphleoea) are both usually small and scrubby. The oak rarely exceeds 25 feet in height and 10 inches in diameter breast high, but specimens occur 60 feet high and 20 inches in diameter. The alligator juniper usually has a large basic diameter, frequently reaching 36 inches, but is a very short tree rarely exceeding 15 feet in height. The trunk usually divides into many large branches within a short distance of the ground. The oak usually has heart rot if over a fewinches in diameter and both it and the cedars are suitable only for fence post material or cordwood.

The Douglas fir (Pseudotsuga taxifolia) when it occurs in this type may be found usually on the northeastern slopes where moisture conditions are favorable. It is usually very scrubby and often defective. The total volume occuring in this type is insignificant.

The white fir (Abies concolor) is found usually in company with the Douglas fir and is usually stunted and very bushy when found in this type. This species is absolutely worthless for timber purposes in this region and fortunately the volume of timber in this species is very small.

The limber pine (Pinus flexilis) which also occurs in this type is found rarely, but usually on northern slopes and in somewhat moist situations and is usually short and scrubby and of no great consequence.

The aspen (Populus tremuloides) is found in the more moist situations and is usually in pure stands in area from five to two hundred acres. This species probably represents the first restocking of large burns. The aspen is small, rarely exceeding 50 feet in height and 12 inches in diameter and most of it is little more than brush. It can be used to a greater or less extent for poles and posts although it is not particularly durable. On account of the open condition of this type the ground cover most frequently met with is herbaceous in character and consists mainly of grasses and there are a great many species. These furnish abundant feed for the cattle, horses and sheep which graze on the Forest.

The reproduction in this type is unsatisfactory as a whole, although there are large areas within the Forest where there is fair to good reproduction. The northern part of the Forest has much less reproduction than the southern part of the Forest and on account of the large burned over areas on that part of the Forest, where the reproduction has been destroyed, it will probably take considerable time to secure satisfactory

reproduction. As previously stated, natural reproduction is not satisfactory and as yet artificial reproduction has not been successful. As soon as a successful method of artificial reproduction is ascertained it is hoped that some success can be had for improving the reproduction on the northern part of the Forest.

The lack of reproduction on the northern part of the Forest is probably due to two causes, one of which is fires and the other of which is grazing. The fires have destroyed all of the living reproduction less than a few feet high, and the sheep through trampling and nibbling in the smaller seedlings have prevented a successful reproduction coming in afterwards. It has been observed that natural reproduction is usually favored by logging and particularly by scattering the brush over the ground as this method of brush disposal assists materially the moisture conditions at the surface of the ground and protects the small plants from drying out in the Spring and from the heavy frosts in the Fall.

Insects and diseases have done more or less damage but taking the Forest as a whole the damage done has been very small indeed. This is probably caused by the dry climate of this region.

Lightening is probably one of the most serious sources of damage to the Forest as nearly five percent of the total number of trees in bunched stands of timber show traces of having been struck by lightening. Of course the number struck any one year is very small, but in the aggregate the damage done amounts to a considerable amount.

There are 91,055 acres of cut-over land in this type. Of this amount 11,055 acres are private lands and the remainder is Government land. All logging for saw timber that has been carried on on this Forest has been in this type, and will probably continue in the future.

Transition Type:

The Transition type covers the area above the western yellow pine type in elevation and below the Engelmann spruce type, from about 9,000 feet on the southern slopes and 8,000 feet on the northern slopes upwards to from 9,500 feet to 10,000 feet as the upper limit. It is found only on the San Francisco Peaks and Mormon Mountain. The Douglas fir (Pseudotsuga taxifolia) and white fir (Abies concolor) are the prominent trees of this type. In this type each reaches a height of 100 feet or more and a diameter of 36 inches or more. The individual trees are usually not large, but the crown is long and very thick. Mixed in with the fir, and often at present predominating the stand, is aspen which reaches a height of 60 feet and a diameter of 18 inches, and always limber pine (Pinus flexilis) reaching a height of 60 feet to 80 feet, although often scattered, and a diameter of about 30 inches breast high and in this type very closely resembling the eastern white pine, (Pinus strobus).

Yellow pine (P. scopulorum) also occurs in greater or less number in this type, but they never make up 50% of the stand. In this type the yellow pine shows the general character found in the yellow pine type although it is usually

more stunted and limby than in the Yellow Pine type. This entire type is in the protection forest. It has had no cutting made in it prior to this time and should have no cutting made in it for some time to come as it is much more advisable to hold the entire stand on these high mountain slopes for protection purposes. The Forest of this type consists of closely stocked stands, the density of which is largely due to the large amount of aspen, among which the coniferous species are situated in small groups or isolated individuals. This stand is all aged from small seedlings to overmature trees. There are no distinctly mature or overmature areas. The trees are almost without exception healthy and in good condition. Throughout this type there is abundant seed production and there is ordinarily a very good stand of young growth which is very evenly divided among seedlings, saplings and poles. Over all burns and windfalls aspen predominates with a very small percentage of the fir and the limber pine. Elsewhere the fir predominates with a slight mixture of limber pine and at the lower elevation, Western Yellow Pine.

Engelmann Spruce Type:

The Engelmann spruce type is confined to that part of the Forest above 9,500 feet. This type is found above the previous types and is made up almost entirely of a group of Engelmann spruce (Picea Engelmannii). This tree rarely exceeds 16 inches in diameter breast high and is about 80 feet high and is usually found situated in close stands with a considerable amount of Arizona cork bark fir (Abies Arizonica). This Arizona cork bark fir is also a tall slender tree reach-

ing a diameter breast high of 24 inches and a height of 60 to 80 feet. In the old burns in this type aspen occurs in dense pure stands. There are also in this type scattered limber pine (Pinus flexilis), bristle cone pine (Pinus aristata). The small areas above timber line on the San Francisco Peaks are includued in this type. The close stocked stands in this type become thin, scattered, low and scrubby at the timber line. The continuance of the forest in part of this type is broken by open grass covered tracts or rocky areas where no young growth has come in since forest fires or where the soil cover is too thin for tree growth.

The reproduction in this type is good. Aspen predominates with Engelmann spruce and the Arizona cork bark fir very close to it. The young growth is fairly evenly divided between seedlings, saplings and poles. Up to the present time no cutting whatever has been done in this type and as the type is situated only on the higher elevations and on steep slopes it is advisable to hold it as protection forest and to allow no cutting in it in the immediate future.

Woodland Type:

The Woodland type covers the larger part of the area of the Forest which is found below an elevation of 6,500 feet although it frequently occurs above 7,000 feet. This type is made up of a mixed stand of pinon (Pinus edulis), and a number of species of the juniperus family, among which are Juniperus pachyphleoea, Juniperus monosperma, Juniperus scopulorum,

and probably Juniperus Utahensis. The different members of the juniperus family are called cedars locally and no distinction is made between them. This type has not been fully examined and it is impossible at the present time to give estimates by speciea in this type. However, it is known that the predominate tree of the type is Juniperus monosperma and that the cedars make up about 75% of the type. The material in this type is suitable only for cordwood and posts. All of the different species are short and bushy, usually not over 15 or 20 feet high and are 15 inches in diameter. Over approximately one half of this type the stands are open, the individual trees rarely touching. Over the remainder of the area the stands are often very dense with a close crown and sometimes very difficult to penetrate. In the open part of the stand there is usually a good grass ground cover and through out the stand are numerous parks or small openings on which there is a good herbaceous cover.

Between the main body of this type and the yellow pine type there usually occurs a more or less park like condition with widely scattered trees of this type covering the ground. Only small areas in this type have been cut-over, probably not to exceed a total of 320 acres. It is probable that the utilization of this type will# be deferred for a great many years until the supply of cedars and fence post materials in the east is somewhat depleted.

There is a sub-type of this type which occurs in the more moist situation in the Verde River drainage along

Sycamore, Oak Creek, Beaver Creek and West Clear Creek, where on account of the moisture conditions, alder, walnut, Balm of Gilead, cherry, several species of scrub oak, sycamore, cypress (Cupressus Arizonica) and Cupressus glabra, occur in small stands. These species grow only in very moist situations and furnish material for poles, posts and fire wood.

Without question the Western Yellow Pine type is the most important type of the Forest and will always be so. This type covers 843,055 acres, and of this acreage 61,916.5 or 7.3% are private lands or will be when surveyed. 72,656.5 acres or 8.6% is University and school lands belonging to the Territory, and the remainder, 708,482 or 84.1% is Government land. Of the total area, 91,055 acres is cut-over land, 80,000 acres of which is Government land and 11,055 acres is private land.

Along the entire border of this type of Forest there are considerable areas where, on account of light stands or inaccessable topography, it is advisable to reatin all the forest cover as a protective Forest, in addition to the areas included in the transition type and the Engelmann spruce type. The total are- of the protection forest including the transition and Engelmann spruce type, is 57,000 acres.

Under contract with the Railroad Company prior to the reconveyance of the land, the Arizona Lumber & Timber Company has the right to cut timber and remove it from the land until October 11, 1916 from about 23,000 acres, the

land in this case having been deeded to the United States. The following table gives the stand of timber in the saw timber type. You will note that the privately owned timber amounts to 146,985,000 feet, of which 121,753,000 feet is covered by the Arizona Lumber & Timber Company's contract. The Government timber on the Forest amounts to 85% of the total, and if arrangements are made to control the cutting and the handling of the school and University timber, this Forest will control over 95% of the total stand, and after the Arizona Lumber & Timber Company have completed their cuttings, over 99% of the remaining stand.

&&& Estimate of Timber by Townships in M. ft. B.M.

Township	Merchantable	Forest Protection	Private	School	University
T 12 N, R 9 E:	11,673 M:				
10 E:	50,180 ":				
11 E:	94,800 ":	4,127 M			
12 E:	54,907 ":	2,667 M			
T 13 N, R 9 E:	31,120 ":				
10 E:	146,667 ":	5,440 M.			
11 E:	136,267 ":	8,060 "	4,667M:	9,553 M:	
12 E:	57,407 ":	2,667 "			
T 14 N, R 8 E:	800 ":	1,400 "			
9 E:	77,467 ":	2,993 "			
10 E:	91,713 ":		347":	4,707 M:	
11 E:	86,707 ":	5,333 "	1,240":	4,587 ":	
12 E:	50,667 ":	5,447 "		2,747 ":	
T 15 N, R 8 E:	13,087 ":	5,500 "		167 ":	
9 E:	70,687 ":		280":	5,520 ":	
10 E:	47,767 ":		680":	4,407 ":	
11 E:	40,000 ":	2,360 "	440":	5,487 ":	
12 E:	18,000 ":	787 "	293":	47 ":	
T 16 N, R 7 E:	900 ":	413 "			
8 E:	44,227 ":	3,040 "	267":	3,020 ":	
9 E:	66,600 ":		1,493":	4,607 ":	
10 E:	10,927 ":	3,447 "		613 ":	
11 E:		313 "			
T 17 N, R 6 E:		1,007 "			
7 E:	14,207 ":	4,553 "		280 ":	
8 E:	58,500 ":	2,393 "		3,873 ":	
9 E:	86,220 ":		1,507":	4,993 ":	
10 E:	22,887 ":	3,807 "		740 ":	

Township	Merchantable	Protection	Private	School	University
T 18 N, R 4 E		4,720 M			
5 E		8,513 "			
6 E	11,547 M	7,047 "		413 M	
7 E	40,107 "	3,820 "	307M	2,553 "	
8 E	83,773 "		453"	5,173 "	
9 E	27,273 "	4,340 "	1,427"	660 "	
10 E		3,253 "			
T 19 N, R 4 E	9,287 "	4,813 "			
5 E	127,260 "	5,333 "	20,987"		
6 E	62,593 "	11,400 "	4,500"	2,600 "	
7 E	87,027 "	1,107 "	880"	5,320 "	
8 E	95,827 "		7,067"	10,000 "	
9 E	23,447 "	2,760 "	767"	1,893 "	
T 20 N, R 4 E	16,000 "	2,850 "	23,187 "	2,280 "	
5 E	9,447 "		51;833 "	9,860 "	52,687M
6 E	4,347 "		2,673"	9,813 "	59,920"
7 E					
8 E	50,213 "	4,667 "	4,320"	8,447 "	
9 E	1,627 "	427 "			
T 21 N, R 5 E			4,600"	4,333 "	9,893"
6 E	22,420 "	6,247 "	6,933"	16,360 "	16,360"
7 E	6,393 "		2,357"	7,117 "	21,013
8 E	33,700 "	2,667 "		4,440 "	27,497
T 22 N, R 6 E	11,157 "	4,600 "		2,027 "	
7 E	61,620 "	31,163 "	1,833"	8,359 "	
8 E	54,300 "	1,687 "		1,953 "	
9 E	58,593 "				
T 23 N, R 6 E	24,627 "	2,487 "	1,333"	507 "	
7 E	43,853 "	39,913		4,193 "	
8 E	70,260 "	4,533 "			
9 E		3,687 "			
T 24 N, R 6 E	27,220 "	2,180 "		2,027 "	
7 E	21,893 "	2,960 "		267 "	
8 E		15,767 "			
Totals	2,466,195 "	242,441 "	146,985"	150,516"	187,370"
Percentage	77.3%	7.6%	4.6%	4.7%	5.8%

Total Timber 3,193,507 M.

The Woodland type contains 571,227 acres of which 23,247.25 or 4.0% is privately owned and 9,968.1 acres or 1.8% is school and University land, and the remainder, 538,011.65 acres or 94.2% is Government timber. About 320 acres of the school area and 2,880 acres of Government timber have been burned over, and about 320 acres of Government timber has been cut-over under timber sales and free use.

The total amount of timber in this type amounts to 3,500,000 cords, of which 3,360,000 cords or 96% is Government. 6,000 cords are on school and university land and 134,000 cords on private land, making a total of alienated timber of 140,000 cords or 4%.

In the Western Yellow Pine type the preferred species is always western yellow pine. The general method of handling this type is to retain all thrifty timber which approximates 25% to 30% of the virgin stand. This makes a selective system of forest management and allows the retention of sufficient seed trees to seed up the area and provides for a secondary cut in from 50 to 150 years after satisfactory reproduction is started.

In the woodland practically the same method of management will be followed. The preferred species will probably be the Juniperus monosperma or Juniperus Utahensis. As yet cuttings in this type have been on such a limited scale and will probably remain so for some time in the future that a working plan for this type has not yet been made out. The free use on this Forest amounts to about $1,500.00 per annum of which approximately one-half is dead material used in connection with range improvements and construction of buildings for homesteads. The dead material usually is used for range improvement (fence posts), and for fire wood. On account of the long period of time in which the area in this Forest has been under jurisdiction, a very large number of sales have

been made most of which are completed at the present time. An examination of the receipts of this Forest in the past will show the quantity of material thus obtained. There are two large sales now in force.

The Greenlaw Lumber Company sale was originally made for 90,000,000 feet, but on account of the failure on the part of the Company to cut the amount required during the first three years it has been reduced to about 60,000,000 feet. This sale will run out July 26, 1912. The areas tributary to this mill will, on an annual cut of 10,000,000 feet, supply timber for about fifteen years. As there is a large amount of capital invested in this mill it seems advisable, after the present sale is completed, to continue sales to this Company at a rate not to exceed 10,000,000 feet per annum. This Company will have to cut during the present and next fiscal year about 30,000,000 feet in order to cut all the amount required in their contract.

In the Flagstaff Lumber Manufacturing Company's sale of January 22, 1909, the original contract calls for 75,000,000 feet, 5,000,000 feet of which were to be cut before January 1, 1911, and the remainder to be cut inequal installments annually during the next four years. As they will not quite cut the 5,000,000 feet before the first of January, 1911, they will have to cut during the next four years, approximately 19,000,000 feet per annum. The timber tributary to this sale amounts to about a billion and a half feet and when the present sale is completed, future sales should be made to this Company at the rate of about 15,000,000 feet per annum.

The Arizona Lumber & Timber Company is not purchasing timber from the Government at present, but are endeavoring to cut off thé# timber from the area on which they own timber, before the contract expires. The Company will not be cutting Government timber, in all probability, before the fiscal year of 1918, and it will probably be advisable at that time to sell them Government timber adjoining their present holdings. As the bulk of the school and university timber is found on the alternate sections in the area which they have already cut, and as the Forest Service will probably have come to control this timber before that time, it will probably be advisable to sell this school and university timber to this Company, in sales not to exceed 15,000,000 feet per annum. The total amount at present tributary to this mill is about 800,000,000 feet.

Ohher small sales will probably amount to about 2,000,000 feet per annum. The annual cut during the next ten fiscal years will be about as follows:

1911	20,000,000	feet.
1912	33,000,000	"
1913	30,000,000	"
1914	30,000,000	"
1915	30,000,000	"
1916	27,000,000	"
1917	27,000,000	"
1918	27,000,000	"
v1919	27,000,000	"
1920	27,000,000	"

No account is made in these estimates for the possible sales to the Arizona Lumber & Timber Company as the Company will probably cut university and school timber during this period, the receipts for ohich will in all probability go to the

Territorial and not to the Forest Service funds. The attached map shows the location and areas of these large sales. You will also find on the attached map the cut-over areas, but you will note that no distinction is made on the map between the private and Government owned areas as the private lands are scattered in among the Government lands.

As previously stated the yellow pine type was completely estimated and mapped by reconnaissance parties during the field season of 1908 and 1909. A working plan for this type is at the present time in the process of preparation and will probably be issued within a few months. When the estimates are revised as they are in this report the actual cost of the work amounts to 1.16¢ per acre and .36¢ per thousand feet of the estimate.

Burns

You will also find on this map, the areas or burns which were serious enough to destroy the stand and thus delay the reproduction. As previously stated these consist of 7,000 acres on the San Francisco Peaks in the transition and Engelmann spruce types and 3,200 acres near Winona Station on the Santa Fe, in the Woodland type. On these areas practically all of the merchantable timber was destroyed. It is not to be understood that these are the only areas on which fires have occurred, but it is to be understood that these are the only areas on which the merchantable timber was completely destroyed. Over 80% of the Yellow Pine type has been burned over one or more times and numerous small areas in the Woodland

type approximating about 3% of the total area had been burned over by more or less severe fires. The fires in both of these types have usually destroyed only a small amount of the standing timber and the bulk of the reproduction on the ground at the time the fires occurred. As soon as the small trees reach a height of five feet or more they are usually not damaged by fire.

Protection

On account of the nearly level but somewhat rolling condition of the Forest and the numerous roads already in existence, it is easy to overlook, from the more prominent points, the whole Forest. The present protective plan is based first on look-out points, second on telephone lines and third on co-operation with the Forest users. Except for a small area north of the San Francisco Peaks, the entire Forest can be over-looked from Woody Mountain and Baker's Butte. Baker's Butte is already connected with telephone line and Woody Mountain will be connected as soon as arrangements can be made to build the telephone line. Four District Ranger Stations are already connected with telephone and it is planned to connect the other District headquarters with telephones as soon as funds are available. It will require approximately $5,000 tp complete a telephone system and $2,000 should be spent during the next fiscal year.

The various Forest permittees are required by the terms of their permits to furnish assistance in case of fires and up to the present time there has been little trouble in

securing their assistance. The public has been very prompt at all times to notify the Forest Officers in case of fires, with the result that since 1903 there have not been any large or very serious fires on this Forest with the exception of the fire which started in the Woodland type this year and burned over 3,200 acres. As soon as the different Ranger Stations are equipped with supplies and connected with telephone so that daily communication with Forest Officers is possible, the protection of this Forest from fire will be practically assured.

Grazing

This Forest produces a very large quantity of forage over its entire area, practically all of which is suitable and available for grazing purposes. The range on this Forest is considered the best in Arizona. There are on the Forest 96,606 head of sheep, grazing fees being paid on 89,550 of them. Of this total about 91,000 of them are on the Forest during the Summer period from April 10 to November 20, and about 5,000 are on the Forest during the Winter period constituting the remainder of the year.

The Forest also carries 33,900 head of cattle and horses, of which about 25,000 are on the Forest the year-round and the remainder only during the Summer season from the first of April until November 30. In addition to this there are on the Forest During the Summer 550 head of cattle under Regulation 65, which graze free of charge.

This Forest is at present practically fully stocked

but will probably carry a slight amount above these numbers. The benefit derived by the stockmen from the privilege of using the Forest is extremely great, and the benefit received by the Forest Service are also great as the stock keeps down the grass and weeds which otherwise would make a large amount of inflammable material on the surface of the ground. There is, however, a drawback in the too complete use of the range which is sure to occur on small areas on a fully stocked forest, as stock of all kinds and especially sheep, when other feed becomes scarce or scattering, will eat the leaves of reproduction and thus injure the Forest materially by destroying the young growth. It is estimated in the working plan that about 10% of the reproduction is injured in this way.

For the protection of the stock owners a hunter has been employed for the past year on this Forest and has met with excellent results in decreasing the number of predatory animals on the range. The Forest is in the main rather free from poisonous plants, although there are a number of cases of stock loss through poisonous plants every year, but the total amount lost in any one year is very small indeed. The present plants supposed to be responsible are species of the loco, larkspur and rubber weed, all of which have been reported and are under investigation at the present time.

Mining

The areas on this Forest having been, as previously stated, covered with a thick deposit of lava or ashes over almost its entire area has no minerals lying close to the

surface. Lying directly under the lava cap is a layer of limestone about 1,100 feet thick and under this a layer of sandstone of about the same thickness. In one or two localities, especially in the vicinity of Flagstaff and in the vicinity of Long Valley in the southern part of the Forest the limestone and sandstone crops out to the surface. Neither of these bear minerals of value, although both are suitable and are used for building purposes. Except in a few small mining claims, containing small quarries for obtaining limestone and sandstone, there are no mineral claims on the Forest, and none of those now on the Forest are patented.

Agricultural Settlement

There are on this Forest approximately 15,000 acres of land suitable under present conditions for agricultural purposes. The agricultural possibilities of this region are not extensive. The Forest has an average rainfall in the saw timber type, of about twenty-three inches and on the remainder of the Forest, about eighteen inches. There is throughout the entire Forest each Spring, a dry season extending from about the first of April until the middle of July covering the time crops should be planted. Over the greater part of the area frosts occur as late as the middle of June ans as early as the middle of September. On the bulk of the area the only crops raised are oats, oat hay and potatoes.

In the southern portion of the Forest on Oak and Beaver Creeks there is sufficient water for a small number of ranches where irrigation can be carried on and there all sorts

of fruits and vegetables are raised. The area of such land, however, is very small comparatively speaking, probably being less than 1000 acres under cultivation. There is probably about 5,000 acres at present under cultivation on the Forest. Since the Act of June 11, 1906 became effective, there have been listed under the terms of this Act on this Forest, 8,162.78 acres. You will note that the total aggregation of patented land is approximately 95,163.75 acres and of that only about 10,000 acres can be used for agricultural purposes. Applications under the Act of June 11, 1906 are now on file for about 2,000 acres additional and it is probable that in the next few years the greater part of the agricultural land on the Forest will be listed and will so pass into private hands.

Permanent Improvements

Before July 1, 1907 improvements in the way of repairing roads, trails and the construction of Ranger headquarters were charged up against general expense under the general Forest Service authorization and no separate records were kept for them. Since July 1, 1907 the following improvement work has been done on this Forest: 16 cabins have been built or remodeled; 28 1/2 miles of administrative fence has been built; 71 miles of telephone lines have been constructed; 5 barns and 9 other buildings have been built and 4 miles of trails have been constructed. In addition to this money has been spent on repairs and maintenance of telephone lines, additional repairs and painting of several of the Ranger

Stations after their construction, a number of wells dug, water troughs installed, etc.# This work has been done at a total expense of $19,705.90. There remains improvement work to be done on this Forest, the construction of about 90 miles of telephone lines; the construction of a large number of cabins, barns and considerable mileage of fences for administrative purposes in addition to approximately 200 miles of boundary fence which should be constructed. These improvements will probably cost a total of $100,000.00.

During the next two years about $6,000.00 should be allotted to this Forest in order to complete the telephone lines and the construction of several badly needed Ranger Stations and to maintain the present improvements. In the following six years $5,000.00 should be allotted this Forest for the maintenance of existing improvements and the construction of additional telephone lines, fences and Ranger station improvements which are urgently required. The remainder of the improvement work should be scattered out over a longer period and about $1,000.00 per year given this Forest for maintenance of existing improvements and additional construction.

Special Work

In the Winter of 1907-8 there was constructed on this Forest 67 miles of fire lines, the greater part of which were 100 feet wide and extended through old cuttings made by the Arizona Lumber & Timber Company so as to provide a method of quickly handling the fires which occurred in the areas cut-over by them. The total area of the fire lines

amounts to about 815 acres, the total cost was $2,892.28 or an average cost of $3.55 per acre.

During the fiscal years of 1909 and 1910 work was done under the supervision of this office in the collection of western yellow pine seed. While the work during the fiscal year of 1910 was actually done on the Tusayan Forest, the credit actually belongs to the Coconino office as the was was handled by the office at Flagstaff and by men detailed from the present Coconino force.

In 1909, 1,335 pounds of western yellow pine seed were collected at a total cost of $1,213.58 or at an average cost of $0.9089 per pound. This large cost was due primarily to the fact that the trees from which the seed was obtained were felled by laborers paid for under this heading and that the necessary equipment for collecting the seed has to be purchased and charged up against the cost of this work. The aeed this year was collected on Sections 3 and 9 in Tp. 21 N, R 8 E, within the boundaries of the Greenlaw Lumber Company's sale of October 30, 1906.

For the fiscal year 1910, 1,660 pounds of western yellow pine seed were collected at a total cost of $885.20, averaging $0.533 per pound. Very little equipment was required this year and the cost in this case represents about what it would cost when equipment is furnished. The seed collected in the fiscal year 1910 was collected from Section 20, Tp. 22 N, R 4 E, within the area of the J. M. Dennis Lumber Company's timber sale of May 7, 1907.

Coconino Experiment Station

In the fiscal year 1909 the Coconino Experiment Station was established at Fort Valley in conjunction with the Fort Valley Ranger Station. During that fiscal year its expenses were paid by the District Office in Albuquerque, New Mexico. In the data given in this report the expenses for the Station for the fiscal year 1910 and proposed future expenses are included within the estimates for the Coconino Forest. A separate statement by Mr. Pearson, Forest Examiner in Charge of the Station, in regard to the work of this Station is attached hereto as part of this report.

Financial Returns

On account of the fact that the present Coconino is made up of parts of several old Forests and has had several additions and eliminations, it is rather difficult to ascertain the actual receipts and expenditures of this Forest. Prior to the fiscal year of 1906 the finoial returns of this Forest were very small, averaging less than $200.00 per year. After carefully examining the old records and adjusting the receipts I have ascertained that the following are the receipts as closely as can be ascertained from the area now embraced within the Coconino National Forest:

Year	Timber Sales	Grazing	Other Sources	Total
1906	$ 109.93	$ 14,171.50	$ 135.00	$ 14,416.43
1907	14,711.00	15,184.55	700.00	30,595.55
1908	61,041.26	18,704.93	725.00	80,471.19
1909	12,952.25	18,479.65	1,200.00	32,631.90
1910	46,649.58	17,235.45	458.59	64,343.62
Totals	$135,464.02	$83,776.08	$3,218,59	$222,458.69

The probable receipts for the next ten years have

been very carefully compiled and are without doubt conservative:

Year	Timber Sales	Grazing	Other Sources	Total
1911	65,000.00	17,500.00	1,100.00	83,600.00
1912	115,000.00	17,500.00	1,200.00	133,700.00
1913	105,000.00	17,500.00	1,300.00	123,800.00
1914	105,000.00	17,500.00	1,400.00	123,900.00
1915	105,000.00	17,500.00	1,500.00	124,000.00
1916	110,000.00	18,000.00	1,600.00	129,600.00
1917	110,000.00	18,000.00	1,700.00	129,700.00
1918	110,000.00	18,000.00	1,800.00	129,800.00
1919	110,000.00	18,000.00	1,900.00	129,900.00
1920	110,000.00	18,000.00	2,000.00	130,000.00

For the reasons given above, the expenditures since the beginning of the fiscal year 1906 have been rather hard to ascertain, but the following table shows as closely as can be ascertianed, the actual expenditures for this Forest during the past five years:

Year	Salaries	Improvements	Other Expenses	Total
1906	$ 12,940.00	$ - -	$ 445.43	$ 13,285.43
1907	16,260.63	- -	839.40	17,100.03
1908	17,087.78	5,016.26	1,557.18	23,661.22
1909	19,508.05	7,249.06	5,304.91	32,062.02
1910	24,591.99	7,440.58	9,831.58	41,864.15*
Totals	$90,388.45	$19,705.90	$17,987.50	$128,072.85

*(Note:- The total for 1910 includes $9,952.50 spent by the Coconino Experiment Station).

A careful comparison of this table with the receipts will show that the Forest has more than paid its running expenses during each of the last five fiscal years, and that it has during that period built up a surplus over expenses, of about $94,000.00. That this Forest is, without question, at present on a paying basis and will be permanently on such a basis can be seen from the above.

The probable expenses for the next ten years have been

carefully estimated and are given fully in the following table:

Year	Salaries	Improvements	Other Expenses	Total
1911	30,400.00	3,150.00	10,000.00	43,550.00
1912	33,500.00	6,000.00	11,000.00	50,500.00
1913	34,000.00	6,000.00	11,000.00	51,000.00
1914	35,000.00	5,000.00	12,000.00	52,000.00
1915	36,000.00	5,000.00	12,000.00	53,000.00
1916	37,000.00	5,000.00	12,000.00	54,000.00
1917	38,000.00	5,000.00	12,000.00	55,000.00
1918	38,000.00	5,000.00	12,500.00	55,500.00
1919	38,500.00	5,000.00	12,500.00	56,000.00
1920	39,000.00	1,000.00	13,000.00	53,000.00

(Note:- These figures include an amount each year ranging from $12,800.00 in 1911 to $15,000.00 in 1920 for the Coconino Experiment Station.)

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COCONINO EXPERIMENT STATION.

The Coconino Experiment Station was established on this Forest in the summer of 1908. While the activities of the Station have been confined mainly to the Coconino National Forest, the nature and scope of the problems undertaken are such as to render the results applicable to the whole, or at least a considerable portion of the District.

The Experiment Station consists of an office in Flagstaff and a field station at Fort Valley, nine miles northwest from Flagstaff. The improvements at the field station consist of a combined office and dwelling house, a combined laboratory and store house and a water plant consisting of a well, windmill and elevated tank. The permanent working force is made up of three technical men and a clerk. Temporary scientific assistants and laborers are employed during the summer months. While the field work is largely concentrated at Fort Valley, it is by no means confined to this place, but extends over the whole Forest or to other Forests as conditions demand.

The following is a summary of the technical work completed and in progress:

Investigations Completed

1. Reproduction of Western Yellow Pine. This tree, which constitutes practically the whole commercial timber supply in Arizona and New Mexico, reproduces very sparingly after cutting over a large portion of its range in these two territories. An investigation conducted during the summer of 1908 showed that the failure of this species to regenerate itself satisfactorily is due primarily to the adverse climatic conditions which prevail in the Southwest, but that fairly good reproduction can generally be obtained by conservative cutting, a rigid exclusion of fires and a judicial regulation of grazing. (Forest Service Circular No. 174, 1909).

2. Meteorological Studies. Meteorological observations in the forest and on denuded or naturally open areas show that the forest exercises a decided moderating influence upon temperature extremes, wind movement and evaporation, within the timbered areas. The influence upon the conservation of water manifests itself in retarding the rate of melting of snows. The facts established in regard to the influence of a forest cover upon temperature, wind and evaporation are of great practical importance in the regulation of cutting on areas where natural regeneration is desired. (A Comparative Meteorological Study of Open Parks and Timbered Areas in the Western Yellow Pine Forests of the South Western United States. G. A. Pearson, 1910.)

3. Seed Tests. A comparison of different ages and conditions of western yellow pine with respect

to the germinative quality of the seed produced gives the following results: Trees from 140 to 250 years of age show a germination 8 percent higher than trees 250 to 400 years old; trees infested by mistletoe and bark beetle show a germination 31 and 17 percent respectively below that of unaffected trees. These data are of exceedingly great value in selecting trees to provide for regeneration after cutting. (The Influence of Age and Condition of Trees upon Seed Production in Western Yellow Pine. G. A. Pearson. 1910).

4. Injury to Reproduction by Grazing. An exhaustive field investigation of this important subject has just been completed. The findings indicate that much less damage is done during the summer months when green feed is abundant than in the early and late parts of the season. It is pointed out by the investigator that the damage might be greatly reduced by providing additional watering places for stock, which would secure a more uniform utilization of the range and also enable the protection of areas in the process of regeneration during the period of maximum injury. (Report not yet completed).

5. Management of Mixed Stands on the Apache National Forest. An extensive field study with the object of devising a scheme of management for the mixed stands

of western yellow pine, Douglas Fir and blue spruce on the Apache National Forest has just been completed. Accurate data have been obtained on the age, rate of growth and reproductive capacity of each species. (Report not yet completed).

Investigations in Progress.

1. Planting in this region is rendered extremely difficult by the severe drought which prevails during the spring months. From April 1 to July 15 there is practically no rainfall, and the strong dry winds from the southwest cause a terrific evaporation. The result is that plants set out in the spring generally die before the summer rains begin. Summer planting during the rainy season has failed because the plants fail to harden up before winter sets in. Under such unfavorable climatic conditions, success cannot be expected without the most hardy, acclimated stock. Since no homegrown stock of sufficient age has been available, planting operations during the past two years have been conducted on a small scale, in anticipation of the probable failure of imported plants. Plots of from 1/4 to 1 acre have been planted to western yellow pine on three different sites formerly occupied by heavy stands of this species. The results of these experiments demonstrate the necessity of using onlu the sturdiest, acclimated

plants, and further indicate that it will probably be necessary to resort to specialized methods such as pot planting, possibly assisted by cultivation. A small amount of home grown stock will be available for planting in 1911.

Douglas fir planted under the cover of aspen on old burns in the native altitude of the species has given gratifying results.

2. Sowing. Broadcast sowing of all species has proven almost a total failure. Spring, summer and fall sowings have been tried on six different sites, with practically the same results. Harrowing has increased the percent of germination but has added practically nothing to the results at the end of a year. A few plots show 1500 or 2000 living plants per acre in the second season, but the number of almost total failures brings the average much below this figure. The main cause of these failures is, as in the case of planting, the extreme drought of the spring months. Seeds rarely germinate until the rainy season is well advanced, in July or August. Germination is usually good; but the plants are destroyed by rodents, birds, "damping off", drought and frost.

Seed spots sown in 1910 were entirely destroyed by rodents. In the future seed spots are to be established on plots spaded up the preceding year and protected from rodents by a small screen.

3. Nursery. The nursery is located at the Fort Valley station. The plan is to grow only enough material to supply the needs for experimental planting. The work has been seriously hampered in the past by the lack of water; but an adequate water system has been installed during the season just passed. Owing to the fact that the nursery has been in existence only two years, none of the stock has been transplanted to the field, but a small amount will be available for next season. In our nursery practice the object constantly kept in view is the production of hardy plants with fibrous root systems adapted to planting.

4. Permanent Sample Plots. Four permanent sample plots aggregating 1286 acres were established on the Coconino National Forest in 1909 and 1910. The object of these plots is to ascertain the actual rate of growth; the loss from windfall, lightning and other causes; and the effect of different degrees of cutting, methods of brush disposal, grazing and other factors upon reproduction. The records include the following data: Exact diameter measurement of all trees 4 inches and over in diameter; exact diameter and height measurement and full description of each individual tree 4 inches and over in diameter on 5 percent of the total area; a map showing the exact location of each tree, and group of saplings and seedlings over 1 foot high on 5 percent of the total

area. By remeasuring and remapping each area at 5 or 10 year intervals, the rate of growth and regeneration can be accurately ascertained.

5. Effect of Mistletoe. During the past summer several hundred trees, affected and unaffected, were measured at different points on the trunk and branches, each point of measurement being permanently marked. Each tree was also fully described and, in most cases, photographed. Future examinations and measurements will show the effect of mistletoe upon the rate of growth and development of each tree.

6. Durability of Different Trees for Fence Posts. Ten to thirty posts from each of eight local species have been set in the ground under uniform conditions, in fence construction. Each post is numbered, described and its position in the fence indicated in the records. Both green and seasoned posts from the following species have been used: western yellow pine, pinon pine, limber pine, Douglas fir, aspen, Gambel oak, alligator juniper and one-seed juniper.

7. Range Improvement. Observations indicate that in certain localities the best grasses are being supplanted by inferior ones, because of the fact that the former are cropped closely and thus prevented from seeding, while the latter seed practically without interference. On such areas, grazing should be restricted to the fall of the year, thus allowing the good forage

plants to go to seed, and at the same time favoring germination by trampling the matured seed into the ground.

Attempts at the introduction# of cultivated forage plants on the range have given little success. Timothy, brome-grass, orchard grass, Kentucky blue grass, German rye and red top were sown in the summer and fall of 1909. In each case a portion of the seed was harrowed in. The timothy was a partial success but all the other species failed. Timothy, alfalfa and brome grass sown on plowed ground in the summer of 1910 came up well and promise to make a success.

8. Meteorological Studies. Instrumental records are being obtained, with a view of ascertaining the climatic factors which determine the main types of forest growth in this region.